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Crucible Cast from Beryllium Oxide and Refractory Cement is Impervious to Flux and Molten Metal

The problem:

To cast a large crucible which will not deteriorate in the presence of fused salt-molten metal mixtures such as uranium-magnesium-zinc-halide salt systems. Large vessels made from pure BeO cannot be cast and fired because the BeO lacks strength before curing.

The solution:

Cast a large crucible from a mixture of a beryllium oxide aggregate and hydraulic refractory cement, and coat the vessel with an impervious refractory oxide. The cement gives high precure strength to the structure, and the oxide coating increases the crucible's resistance to fused salt and molten metal.

How it's done:

A mixture comprising 85%–93% by dry weight of BeO and 7%–15% hydraulic refractory cement is cast in the desired vessel shape and fired at 1200° F. The refractory cement, which contains 3 or 4 of the components alumina, magnesia, baria, strontia, or calcia, forms eutectic bonds with the BeO when fired at this temperature. These cement components are inert in the fused salt-molten metal environment. The cast and fired crucible has a 10%–20% porosity which is desirable for thermal shock resistance.

After the initial firing of the vessel, a coating of refractory oxides is applied to the vessel inner surfaces and fired to form eutectic phases with the BeO.

Two coating compositions found effective with BeO and resistant to attack by the fused salt and molten metal contain the following compounds, in percentage by weight:

	Coating #1	Coating #2
Al ₂ O ₃	28%	55%
BeO	27.5%	
MgO	44.5%	
CaO		35%
SrO		10%

Large, impervious vessels with thick walls and high impact resistance, made of coarse economic grades of BeO, can be cast effectively by this method.

Notes:

1. Al₂O₃ appears to be an essential component in the coating material.
2. Vessels cast by this process can be used in the flux reduction of oxides of thorium and uranium.
3. Additional information concerning this innovation is given in U.S. Patent No. 3,150,281, available from the U.S. Patent Office. Inquiries may also be directed to:

Office of Industrial Cooperation
Argonne National Laboratory
9700 S. Cass Avenue
Argonne, Illinois 60439
Reference: B66-10527

(continued overleaf)

Patent status:

Inquiries about obtaining rights for commercial use
of this innovation may be made to:

Mr. George H. Lee, Chief
Chicago Patent Group
U.S. Atomic Energy Commission
Chicago Operations Office
9800 S. Cass Avenue
Argonne, Illinois 60439

Source: Z. D. Jastrzebski
Chemical Engineering Division
(ARG-22)